

Summary and Commentary on Sea-Level Rise Adaptation Language in Florida Local Government Comprehensive Plans and Ordinances¹

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July, 2015

I.	Introduction	3
II.	Counties.....	8
1)	Brevard County	8
2)	Broward County	8
3)	Charlotte County	16
4)	Collier County	17
5)	Dade County.....	17
6)	Monroe County	19
7)	Palm Beach County	20
8)	Pinellas County	20
9)	Sarasota County.....	21
10)	St. Lucie County.....	22
11)	Volusia County.....	23
¹⁾ III.	Municipalities.....	23
²⁾		
³⁾	Fernandina Beach.....	23
⁴⁾	Fort Lauderdale	24
⁵⁾	Fort Pierce	28
	Hallandale (Beach).....	28
	Hollywood.....	28

¹ This work represents a draft of work funded in part by a grant from the Houston Endowment for inclusion in a larger report by the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University – Corpus Christi on sea-level rise to be released in 2016. As such, all rights to this work are reserved to the Houston Endowment, and this early work is made available by permission. Recommended citation: HOUSTON ENDOWMENT, THOMAS RUPPERT & ALEX STEWART, DRAFT: SUMMARY AND COMMENTARY ON SEA-LEVEL RISE ADAPTATION LANGUAGE IN FLORIDA LOCAL GOVERNMENT COMPREHENSIVE PLANS AND ORDINANCES (July 2015).

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	Islamorada	29
	Key West	29
	Lauderdale-by-the-Sea	31
	Miramar	32
6)	Neptune Beach	32
7)		
8)	New Smyrna Beach	32
9)	Ormond Beach.....	33
10)		
11)	Palm Beach Shores	33
12)	Pinecrest	33
13)	Palm Coast.....	36
14)	Pompano Beach.....	36
15)		
16)	Port Orange	37
17)	Port St. Lucie.....	37
18)	Punta Gorda.....	38
19)		
20)	Satellite Beach.....	38
21)	West Palm Beach	39
22)	Yankeetown.....	39
	IV. Conclusion	39
	V. Appendix	41

I. Introduction

Sea-level rise is occurring. Credible scientific evidence has resulted in a consensus that sea-level rise (SLR) will not only continue but that it will increase dramatically for the foreseeable future. Florida, as a low-lying state with extensive coastline, ranks as one of the most at-risk states for sea-level rise impacts. Thus, it might be assumed that Florida would be on the forefront of addressing the impacts of and adaptation to SLR. However, this has not been the case across the state. While some segments of state government have some focus on the issue (i.e.—the Florida Fish and Wildlife Conservation Commission and the Florida Department of Economic Opportunity), recent press has discussed accusations that state employees have been instructed to not use the terms “climate change” and “sea-level rise.”

Now, much of this may be set to change. On May 21, 2015, Governor Rick Scott signed into law CS/CS/CS Senate Bill 1094, available at <http://laws.flrules.org/2015/69>. The focus of the bill is on flooding. The first section of the bill contains additions to Florida’s comprehensive planning law. The bill modified Florida Statute section 163.3178(2)(f). This section of statutes has long required that coastal management elements of comprehensive plans include a “redevelopment component which outlines the principles which shall be used to eliminate inappropriate and unsafe development in the coastal areas when opportunities arise.” With this new law, Florida Statute section 163.3178(2)(f)1. now includes “sea-level rise” as one of the causes of flood risk that must be addressed in the “redevelopment principles, strategies, and engineering solutions” to reduce flood risk.

Previously the only mention of sea-level rise in the comprehensive planning chapter of Florida Statutes was the permissible language allowing local governments to incorporate “Adaptation Action Areas” into the coastal management element of their comprehensive plans (Fla. Stat. §163.3177(6)(g)10. (2014)) and a definition for “adaptation action area” in Florida Statute section 163.3164(1).

The addition of another reference to sea-level rise, especially one that is mandatory in nature, highlights the realization that sea-level rise represents an important challenge to consider in the long-term resilience of Florida communities.

While the inclusion of SLR as a mandatory part of comprehensive planning represents an advance at the state level in Florida, much of the impacts and costs of SLR still fall to local governments. Considering that Florida has almost 1200 miles of shoreline, including over 650 miles of beaches and extensive, low-lying areas, it remains surprising how few local governments have yet explicitly added SLR to their comprehensive plans or otherwise considered SLR. With almost 500 local governments—research for this document did not include the more than 1,000 special districts in the state—and almost 200 of those required by state statute to prepare “coastal management elements” for their comprehensive plans, it seemed

appropriate to assess how many of the “coastal” counties and municipalities had addressed SLR in their comprehensive plans.

To assess this, extensive on-line research was conducted as well as some personal communications with knowledgeable individuals around the state to find local government documents that discuss SLR. The main focus of research sought to identify SLR in local government comprehensive plans, but in several instances other important local government documents that mention SLR are also included. Though not the focus of this particular project, researchers also often excerpted local government language that addressed climate change or mitigation of climate change rather than just SLR. For further information about the methods of the research conducted, please see the appendix as well as the spreadsheet “SLR in FL local govt docs.xlsx.”

Due to a desire to limit the length of language cut and pasted from local government documents and to focus on SLR, many of the excerpted portions of language appear below separate from other language that might be relevant. Thus, if readers are particularly interested by language from a local government, it is strongly advisable to go to the original source material and examine whether excerpted language requires the context of other provisions in the documents where they appear to be fully understood. For example, the City of Satellite Beach only has two sections of its Coastal Management-Conservation Element that explicitly mention SLR (Objective 1.12A and Policy 1.21A.2). Yet the ordinance (#1066, passed March 3, 2013) that added these references contains a larger framework of changes to the comprehensive plan to address SLR. In the section on Satellite Beach, below, sections added at the same time via the same ordinance as the SLR references were added to the text for this fuller context of how Satellite Beach links flooding issues, SLR, resilience, and flood insurance costs.

Another note is in order regarding comprehensive plans. While all local governments included in this research are required to have comprehensive plans, when SLR language appears in a comprehensive plan and indicates that a local government “shall” do something (e.g. the local government “shall work with Nassau County and state and regional entities as appropriate to develop strategies for responding to sea-level rise, including . . . Consideration of the effects of sea-level rise on potable water sources, saltwater intrusion, septic systems, wastewater treatment facilities, and the water table.”), such language is often not self-executing. This may result in situations in which comprehensive plan language appears more proactive than the tangible actions of a local government in day-to-day operations. This research was not able to separately evaluate the level of implementation of language for each local government that has SLR language in its documents.

After review of the assembled comprehensive plan language or ordinances, a list of 14 types of activities was created based on the contents of the local government documents. Each activity or mention of SLR was given a code, and the frequency of the occurrence in local government

comprehensive plans or ordinances was assessed (supporting document references are not included in this table). The results are in the following table:

# of occurrences	KEY FOR CODES:
3	PI= Providing information on SLR
8	DA= Doing analysis of SLR
7	CA= Coordinating activities related to SLR
5	ID infra = Identify public infrastructure and assets at risk of SLR impacts
5	STRMWTR = Add SLR to stormwater design and planning
4	RISK = Designate areas at risk for SLR impacts
2	Fut.RISK = Discourage density increases in places of future SLR-induced vulnerability (this often may be present in comprehensive plans that this research did not review because the plans lacked explicit reference to SLR or may be in parts of plans that were reviewed, but not in the sections reviewed and included here; this is very likely as Florida Statutes require this to be part of comprehensive plans, Fla. Stat. §§ 163.3177(6)(g)4, 6, & 7; 163.3178(2), though implementation may be lacking in many communities)
6	InfraRR = Consider SLR in infrastructure replacement and for potential relocation
12	CNSDR = "Consider" SLR in particular decision making
2	DEV = Support increased development in safer coastal areas not at risk from SLR
6	AAA = Develop Adaptation Action Areas
6	MON = Monitor SLR and potential impacts
10	CC/GHG = mention of climate change and/or greenhouse gases
4	MENT = SLR mentioned but no specific action/policy implemented or req'd

Based on the local government language identified through this research, a few local governments stand out for how carefully they have spelled out what they will do in response to SLR. The best examples of detailed analysis and incorporation of SLR include Miami-Dade County, Broward County, and Fort Lauderdale.

Each of these three plans contains many similarities:

- They seek to ensure coordination of activities between the local government and other local government units, the state and federal governments, as well as with educational or non-profit institutions that can offer assistance.
- All three are based on extensive supporting materials, so they all are doing extensive analysis of climate change and SLR impacts and will continue to monitor the science on SLR. This allows all three to really understand current risk as well as potential future risk.
- Each of them specifically mentions infrastructure—including specific references to stormwater/drainage; the best ones actually ensure that *any* infrastructure decisions include SLR in the decision-making process. Each of the three analyzes to understand what infrastructure is at risk from SLR. Fort Lauderdale and Miami-Dade go as far as indicating the need to analyze when and whether infrastructure should be relocated due to SLR.
- Two of the three specifically indicate that future development and density increases should be focused in the safest areas.
- Two of the three also discuss development of criteria to identify “Adaptation Action Areas” as noted in Florida Statute sections 163.3164(1) and 163.3177(6)(g)(10).

While these three have the most extensive and complete comprehensive plan references to SLR and the planning actions and policies for SLR, some other local governments also address SLR and deserve special mention. For example, St. Lucie County indicates that it will monitor SLR science and plan accordingly for long-term infrastructure and capital improvement expenditures as well as for resource protection. Fort Pierce, in the same county, has language that also indicates that it will monitor SLR science and consider measures to protect or relocate critical public facilities in areas at risk of future SLR. Pinecrest, which is not even required to have a coastal management element, has an excellent and quite comprehensive CC/SLR element it added in 2015 to its comprehensive plan.

Key West, in the Florida Keys, has a quite extensive references to both SLR and CC; this includes a requirement that the City Planner and City Engineer review SLR predictions and recommend any action needed to address it in current or future projects. Key West also has an innovative draft ordinance allowing exceptions to Key West’s strict building height limitation. Historically Key West has sought to maintain its character by imposing strict building height limitations. However, it became apparent after the 2012 changes to the National Flood Insurance Program that the height restrictions could actually deter or prohibit mitigation of flood damage to

existing structures and prohibit sufficient elevation of new structures to ensure longer-lasting flood protection and lower flood insurance premiums. After passage of a referendum on the issue with over 80% support (<http://www.cityofkeywest-fl.gov/topic/index.php?topicid=77>), the City of Key West is working to finalize a draft ordinance that was included with the referendum (http://www.cityofkeywest-fl.gov/egov/documents/1415296724_93106.pdf). This process can serve as a model for other communities seeking to balance small-town historical character with the need for flood mitigation and lower flood insurance rates.

New Smyrna Beach, a town of only about 23,000 in Volusia County, has comprehensive plan language that commits the town to working with Volusia County on many issues, including development of data, analysis of the geographic extent of possible SLR risk, impacts on natural systems and structures, and evaluation of locating public facilities in areas projected to be impacted by SLR. Another small town on the Atlantic Coast, Satellite Beach, has also been active in incorporating SLR into their comprehensive plan. After several years of activity, in 2013 Satellite Beach finally passed a comprehensive plan amendment that: focuses on development and redevelopment that protects life and property from SLR; seeks to lower flood insurance costs; initiates a public process to identify Adaptation Action Areas per Florida Statutes; and encourages populations concentrations away from known or predicted high hazard areas.

It is important to note that comprehensive plans are not the only document that can house significant SLR or CC policies. While the comprehensive plan has the force of law, many times, more detailed, non-binding documents lead to development of comprehensive plan language, local government policies, and ordinances. Two examples for relatively small communities are: Punta Gorda's extensive adaptation plan document (available at: <http://www.cakex.org/sites/default/files/Punta%20Gorda.pdf>) that is helping guide work at the local level to integrate adaptation more fully into the comprehensive plan, ordinances, and other local government documents as well as the Monroe County Climate Action Plan (available at: <http://www.monroecounty-fl.gov/documentcenter/view/5971>). For an impressive document from a larger local government, see Fort Lauderdale's "Fast Forward Fort Lauderdale, Vision 2035," available at <http://www.fortlauderdale.gov/home/showdocument?id=4202>, which specifically addresses sea-level rise.

Finally, this work almost certainly missed relevant SLR language in some local government documents due to the scope of the project and sometimes limited availability of documents through online sources. Thus, we would like to encourage you to contact us at truppert@ufl.edu if you know of SLR comprehensive plan language or ordinances not included in this database. This will allow this database to serve as a valuable resource to local governments in Florida—and beyond—as local governments in Florida begin or strengthen incorporation of SLR into their comprehensive plans, especially in light of the new 2015 requirement for coastal local governments to do so.

II. Counties

1) Brevard County

I. [Comprehensive Plan](#)

- a. Chapter X, Coastal Management Element, Policy 4.9: “Brevard County shall continue to collect and make available to the public information related to sea level changes.”
- b. Chapter X, Coastal Management Element, Policy 10.3H: “The impact of sea level rise and the projected 30-year erosion line shall also be analyzed.”

2) Broward County

I. [Climate Change Action Plan](#) (#18 at bottom of page)

II. [Comprehensive Plan](#)

- a. Conservation Element- “Policy 13.1.16. Broward County shall develop a county-wide Climate Change Program to mitigate and adapt to the consequences of climate change in coordination with other local governments, private businesses, other governmental agencies and the State of Florida. This program will focus on mitigating the causes and consequences of greenhouse gas emissions in a cost-effective and efficient manner that preserves the County’s economic competitiveness.”
- b. Climate Change Element-“Policy 19.2.2. Broward County shall continue to support and coordinate with local municipalities to further mixed land uses which promotes functional, walkable mixed use development designs and projects by providing flexibility in development review for these projects, revising the zoning and land development codes to support such projects, and promoting the adoption of specific goals in local Comprehensive Plans to support and establish sustainable development patterns, especially in areas at reduced risk to sea level rise, as defined by the Priority Planning Areas

for Sea Level Rise Map in the Broward County Land Use Plan.”

- c. Climate Change Element-“Policy 19.2.6. Broward County should assist in coordinating transportation-related adaptation policies across jurisdictional boundaries and ensure consistency among broader planning and plan implementation efforts. Specifically, strategies for preparing for sea level rise, such as increasing road surface elevation standards, subsurface stabilization, stormwater management and drainage, and adjustment of bridge heights to allow for navigation, should be collaboratively assessed and implemented.”
- d. Climate Change Element-“Policy 19.3.3. Broward County shall continue to review policies and promote programs which advance greenhouse gas reduction and energy conservation strategies; promote compact, transit-oriented, pedestrian-friendly development; further green construction practices and the design of climate sensitive and energy efficient buildings; encourage cluster development in order to retain or create native vegetative communities; and address the resilience and survivability of buildings and infrastructure to rising sea levels, tropical storms, storm surge, and other climate change impacts, consistent with the Community Design Guidebook and the Urban Design, Housing, and Future Unincorporated Area Land Use Elements of the County’s Comprehensive Plan.”
- e. Climate Change Element-“Policy 19.3.4. Broward County shall identify public investments and infrastructure at risk from sea level rise and other climate change related impacts by 2015, and update this assessment every 5 years. Specifically, the County shall analyze vulnerability to facilities and services, including but not limited to: buildings; water and wastewater treatment plants, transmission lines and pumping stations; stormwater systems; roads, rail, bridges, and all transportation and transit infrastructure; power generation facilities and power transmission infrastructure; critical airport and seaport infrastructure; hospitals; city halls, police and fire stations.”
- f. Climate Change Element-“Policy 19.3.7. Broward County shall continue to improve analysis and mapping capabilities for identifying areas of the County vulnerable to sea level rise, tidal flooding, and other impacts of climate change. Acquire increasingly accurate Light Detection And Ranging (LiDAR) data, or other state-of-the-art elevation data, and other necessary modeling data and programs every 5 years to update the Priority Planning Area for Sea Level Rise Map in the County’s Land Use Plan and improve available information needed to make informed decisions regarding adapting to the impacts of

climate change.”

- g. Climate Change Element -“Policy 19.3.8. Broward County shall, by 2015, develop new 100 year stormwater elevation projections in the Broward County 100 year flood map for use in stormwater management permitting and other planning processes, which incorporate current and projected conditions for sea level rise.”
- h. Climate Change Element-“Policy 19.3.9. Broward County, in conjunction with its municipalities and partner agencies, shall work to ensure that adaptation to climate change impacts, especially sea level rise, is incorporated into the planning, siting, construction, replacement and maintenance of public infrastructure in a manner that is cost-effective and that maximizes the use of the infrastructure throughout its expected life span.”
- i. Climate Change Element-“Policy 19.3.12. Broward County shall by 2012, designate areas that are at increased risk of flooding due to, or exacerbated by, sea level rise over the next 50 years within the Broward County Land Use Plan Priority Planning Areas for Sea Level Rise Map, and work to make these areas more climate resilient by discouraging density increases and encouraging the use of adaptation and mitigation strategies.”
- j. Climate Change Element -“Policy 19.3.13. Broward County shall by 2017, work with its local municipalities to designate Adaptation Action Areas, per Florida State Law, using the Priority Planning Areas for Sea Level Rise Map as a basis for identifying areas especially vulnerable to sea level rise, in order to develop policies for adaptation and enhance the funding potential of infrastructure adaptation projects.”
- k. Climate Change Element -“Policy 19.3.14. Broward County shall encourage local municipalities to develop policies to improve resilience to coastal and inland flooding, salt water intrusion, and other related impacts of climate change and sea level rise in their Comprehensive Plans, Sustainability Action Plans, Vision Plans, Stormwater Master Plans, Adaptation Action Areas Plans, Climate Change Plans and other city-wide plans.”
- l. Climate Change Element -“Policy 19.4.12. Broward County, in cooperation with its municipalities and appropriate local agencies, shall evaluate water and stormwater management operation strategies in the context of sea level rise...”
- m. Climate Change Element -“Policy 19.4.15. Broward County should support the efforts of state environmental and planning agencies to

jointly develop, assess, and recommend a suite of planning tools and climate change adaptation strategies for local municipalities to maximize opportunities to protect the beach and dune systems, coastal wetlands, and other coastal resources from the impacts of sea level rise.”

- n. Climate Change Element -“Policy 19.5.7. Broward County shall support recurring and continued development of local integrated models and continuous data collection, to help predict and track the impacts of sea level rise on groundwater levels, saltwater intrusion, and drainage infrastructure through enhanced development and application of local hydrologic models and the use of down-scaled climate models.”
- o. Climate Change Element -“Policy 19.5.13. Broward County shall study whether to build, modify or relocate water, wastewater and stormwater transmission infrastructure to allow for strategic retreat from areas at risk to sea level rise.”
- p. Climate Change Element -“Policy 19.6.2. Broward County shall coordinate regionally with other Southeast Florida counties, academia, and state and federal government agencies in the analysis of sea level rise, drainage and hurricanes impacts and the planning of adaptation measures.”
- q. Climate Change Element -“Policy 19.7.5. Broward County shall work with the Florida Division of Emergency Management and other agencies to incorporate sea level rise and increasing storm surge impacts into the remapping of potential hazard areas in coastal zones by 2015. Revised hazard area designations should better reflect the risks to communities associated with climate change and allow reevaluation of suitability for development or redevelopment in these areas.”
- r. Climate Change Element -“Policy 19.7.6. Broward County shall cooperatively develop model codes and policies to encourage post-hazard redevelopment in areas with less vulnerability to storm surge, inundation, flooding, sea level rise and other impacts of climate change, and incentivize locally appropriate mitigation and adaptation strategies.”
- s. Climate Change Element -“Objective 19.3. Improve the climate resiliency and energy-efficiency of new and existing buildings and public infrastructure, and develop adaptation strategies for areas vulnerable to climate change-related impacts.”
- t. Climate Change Element -“Policy 19.5.9. Broward County shall work

to protect existing well fields, surface or subsurface storage facilities, control structures, water and wastewater treatment plants and transmission infrastructure from increased coastal flooding, sea level rise, saltwater intrusion, and other potential future climate change impacts, and plan for infrastructure replacement and relocation as needed.”

- u. Climate Change Element -“Policy 19.7.4. Broward County shall work to encourage dialogue between residents, businesses, insurance companies and other stakeholders, through public education campaigns and workshops, in order to increase understanding regarding the potential impacts of climate change on our coastal communities and evaluate the shared costs of action or inaction in human, ecological and financial terms.”
- v. Climate Change Element -“Policy 19.7.5. Broward County shall work with the Florida Division of Emergency Management and other agencies to incorporate sea level rise and increasing storm surge impacts into the remapping of potential hazard areas in coastal zones by 2015. Revised hazard area designations should better reflect the risks to communities associated with climate change and allow reevaluation of suitability for development or redevelopment in these areas.”
- w. Climate Change Element -“Policy 19.7.6. Broward County shall cooperatively develop model codes and policies to encourage post-hazard redevelopment in areas with less vulnerability to storm surge, inundation, flooding, sea level rise and other impacts of climate change, and incentivize locally appropriate mitigation and adaptation strategies.”
- x. Climate Change Element -“Policy 19.8.5. Broward County shall consider the public health consequences of climate change, such as extreme temperatures and vector-borne diseases, and take steps to build capacity to respond to or prevent those consequences. Specifically, the County should: a) Encourage research to better understand the public health consequences associated with climate change in Broward County... Create a community-wide public health climate change adaptation plan... Raise the awareness of policy makers, community leaders, businesses, institutions, health care providers, and the general public about the public health significance and related costs of climate change...”
- y. Support Document-Admin. Element-“The Climate Change Element is unique because it has three planning horizons. The short-term is five

years, the mid-term is 10-20 years and the long-term is approximately 50 years to be consistent with the Southeast Florida Climate Change Compact's regionally agreed upon Unified Sea Level Rise Projection."

- z. Support Document-Admin. Element-"There has been widespread international scientific consensus that climate change is occurring. Southeast Florida is extremely vulnerable to sea level rise and storm surge in extreme weather events. Local impacts related to climate change, especially sea level rise, are already happening. Critical public infrastructure including beaches, roadways and especially stormwater drainage treatment and conveyance systems have already begun to show vulnerabilities to the current rate of rise of sea level, extreme rainfall and seasonal high tides. Coastal communities have begun to seek infrastructure improvements to address mounting drainage concerns. The predicted accelerated rate of sea level rise will further exacerbate the impact of saltwater intrusion of our source of drinking water and on coastal habitats. Recognizing these facts, the Broward County Board of County Commissioners (Board) has made planning for the effects of climate change a priority, and on February 12, 2013, adopted the Climate Change Element as part of the Broward County Comprehensive Plan."
- aa. Support Document-Future Land Use-"Smart Growth,' Energy Efficient Development and Land Use Patterns. In order to discourage urban sprawl, create energy efficient land use patterns and help meet Greenhouse gas reduction goals; Objective 2.9 was adopted. The reduction of Greenhouse gas emissions has become very important in light of widespread international scientific consensus that climate change is occurring. Broward County is highly vulnerable to sea level rise and violent weather patterns which the burning of fossil fuels may be contributing to. Therefore it is critical to act locally to reduce Greenhouse gas emissions. "Smart Growth" principles provide a blueprint for reducing Greenhouse gas emissions and developing more energy efficient land use patterns."
- bb. Support Document-Future Land Use-"The five "green" action areas that Broward County has focused on are air quality, recycling, land preservation, water conservation and climate change, more information is available at <http://www.broward.org/gogreen/Pages/Default.aspx>. The County government has been proactive in preparing for the effects of sea level rise and climate change. The Broward County Climate Change Task Force was established to develop recommendations for a coordinated

countywide strategy in mitigating the causes, and addressing the local implications, of global climate change. The task force produced the Broward County Climate Change Action Plan which is currently being implemented.”

- cc. Support Document-Deep Water Port- “Sea level rise and coastal flooding. Changes in sea level have the potential to massively reconfigure geomorphology, change tidal variation, alter salinity patterns, and impact ecological processes in South Florida’s coastal habitats, including wetlands, mangrove forests, and seagrass beds. Though sea-level rise rates have historically been measured from 5 to 10 centimeters per 100 years, that rate has accelerated tenfold in the past hundred years. With the influences of global climate change, sea levels are predicted to rise 0.5 feet by 2050 and 1.1 feet by 2100. The effects of that rate of change may not be inherently visible within the context of the Port’s 20-Year Vision Plan, but it is imperative that long-term planning strategies look toward the future. To anticipate the eventual effects of global climate change on the Port’s shoreline, BCEP&GMD mapped the incremental effects of sea level increases adjacent to the Port, identifying areas at risk for sea level rise in one-foot increments; up to three feet. Most of the areas shown affected by the rise are low-lying with existing vegetation, including mangroves, in the environmentally protected areas. Also affected by sea level rise are the shallow seagrass beds present in various locations in the vicinity of the Port.”
- dd. Support Document-Deep Water Port-“Sea level rise and seagrasses. A major impact on seagrasses of changes resulting from sea level rise will be the redistribution of existing habitats. Distribution changes will result from the effects of salinity change on seed germination, propagule formation, photosynthesis, growth, and biomass (Short and Neckles, 1999). Changes in water depth also impact the flow patterns and deposition of sediments in and around seagrass beds. Alteration of the sediment composition is expected to cause shifts in community structure. Some species have been shown to persist in nutrient-rich sediments high in organic content, whereas others occur in patches characterized by more sandy sediments. An increase in the deposition of sandy beach and offshore sediments in seagrass beds can be expected to promote a shift in species composition. Increased water depth will impact the amount of light reaching existing seagrass beds, thereby affecting productivity, and could result in community decline.”
- ee. Support Document-Deep Water Port-“Sea level rise and underground

stormwater systems. Other areas that could be affected by the rise in sea level are the underground stormwater management systems consisting of exfiltration piping and trenches that are used to filter surface water runoff. These systems need to be above the water table to filter pollutants from the stormwater runoff. Underground exfiltration systems are typically used in paved parking areas and container storage yards to maximize the paved area for use by Port operations.”

- ff. Support Document-Deep Water Port-“Sea level rise and mangroves. Mangrove communities are highly productive systems, providing valuable habitat for fisheries, shorebirds, marine mammals, snakes, and crocodiles. Many of the world’s marine species, including important coastal fisheries, rely on coastal wetlands for at least part of their life cycle. The complex root systems of mangroves serve as refuge for large numbers of species, as well as providing stabilization for sediments, thereby reducing coastal erosion and improving water clarity. Coastal mangrove tracts can provide protection from storm surges to adjacent land and human populations, and prevent damage to freshwater ecosystems and agricultural areas from saltwater intrusion. As sea levels rise, the seaward and landward margins of the mangrove community migrate inland to maintain their preferred environmental conditions, including period, frequency, and depth of inundation; and salinity. Depending on the ability of mangrove species to colonize new habitat at a rate that keeps pace with the rate of relative sea level rise, the slope of adjacent land, and the presence of obstacles to landward migration such as seawalls and other shoreline protection structures, some sites will revert to a narrow mangrove fringe or lose the mangrove community altogether (Gilman et al., 2006). Sea level rise has a direct impact on the frequency and duration of inundations and drying periods of coastal mangrove wetlands, which support a community of small marsh fishes critical as a food source to wading birds such as wood storks, egrets, and roseate spoonbills. Regular periods of water level recession serve to concentrate the fish assemblages in densities adequate to support wading bird nesting. Landward salinity intrusion is another impact of higher sea levels in coastal wetlands. It is a major factor limiting distribution and abundance of various fish species, submerged aquatic vegetation, and estuarine alligator and crocodile populations. Based on B CEP&GMD’s analysis, a one-foot rise in sea level will impact the vast majority of mangrove communities in the Port area. Development

of the land surrounding the mangrove pockets in Port Everglades prevents the natural landward migration of the mangrove communities with rising sea levels; however, the projected time frame for a one-foot sea level rise exceeds that of even the 20-Year Vision Plan.”

- gg. Support Document-Climate Change-“While railroads were not particularly vulnerable, many roads were; especially low volume roads and parking areas. The miles of roads vulnerable increased by a magnitude at each scenario with almost 300 miles of roads inundated at 3 feet of sea level rise.”
- hh. Support Document-Climate Change-“While no wastewater facility appears to be impacted at the one foot sea level rise scenario, the Hollywood and Ferncrest facilities were among the most vulnerable at the two and three foot scenarios.”
- ii. Support Document-Climate Change-“Additionally, sea level rise from climate change is threatening the Florida Everglades, the backbone of our natural resource system.”
- jj. Support Document-Climate Change-“Additionally, The Broward County 2012 Enhanced Local Mitigation Strategy (eLMS) includes a new subsection on climate change and sea level rise in the Risk Assessment chapter, and utilizes wind, flood, and sea level rise hazard risk information in a new Economic Vulnerability chapter. Analysis concludes that the County is likely to continue to be vulnerable to sea level rise, with the level of impacts being moderate to severe.”
- kk. Support Document-Climate Change-“Unfortunately, climate change impacts, especially sea level rise, are already occurring in our County, making adaptation efforts also necessary.”
- ll. Support Document-Climate Change-“A substantial increase in sea level rise within this century is likely and may occur in rapid pulses rather than gradually.”

3) Charlotte County

I. [Comprehensive Plan](#)

- a. FLU Policy 2.4.7: “Short-term Actions to Address the Effects of Climate Change: The County shall consider amending the Code of Laws and Ordinances within one year of the effective date of this comprehensive plan to require that all proposed development address ways to minimize damage from coastal erosion, 100-year floods, tidal surges from hurricanes and coastal storms, and a projected year 2050 0.5 meter sea level rise (FLUM Series Map #15). These measures may include elevating structures on pilings and elevating roadways to

mitigate the impacts of anticipated storm surges, flooding, and sea level rise.”

4) Collier County

I. Land Development Code (Municode)

- a. 3.03.05 - Sea Level Rise “An analysis shall be required demonstrating the impact of a six (6) inch rise in sea level for development projects on a shoreline. This requirement shall be met by inclusion of this analysis in an environmental impact statement (EIS). This requirement shall be waived when an EIS is not required. This analysis shall demonstrate that the development will remain fully functional for its intended use after a 6 inch rise in sea level. In the event that the applicant cannot meet this requirement, a list shall be provided by the applicant of the changes necessary in order for the development to meet the standard.”

5) Dade County

I. [Climate Change Action Plan](#)

- II. Resolution R=451-14: Requires all infrastructure projects (new, maintenance, etc.) to consider SLR projections and potential impacts over 50 years or the life of the project. Also mandates setting priorities for adapting existing infrastructure at risk from SLR.

III. Rules of Procedure of County Commission (MuniCode)

- a. Section 2.01-Rule 5.09: “For all agenda items brought to the Board that relate to the planning, design and/or construction of County infrastructure projects, including but not limited to, County building elevation projects, County installation of mechanical and electrical systems, County infrastructure modifications and County infrastructure renovations, the Mayor or Mayor's designee shall include a statement in the item that the impact of sea level rise has been considered in the project.”

IV. [Comprehensive Plan](#)

- a. LU-3E. “By 2017, Miami-Dade County shall initiate an analysis on climate change and its impacts on the built environment addressing development standards and regulations related to investments in infrastructure, development/redevelopment and public facilities in hazard prone areas. The analysis shall consider and build on pertinent information, analysis and recommendations of the Regional Climate Change Action Plan for the Southeast Florida Regional Climate Change Compact Counties, and will include the following elements: a)

an evaluation of property rights issues and municipal jurisdiction associated with the avoidance of areas at risk for climate hazards including sea level rise; b) an evaluation of the current land supply-demand methodology to consider and address, as appropriate, the risk associated with infrastructure investments in flood prone areas; and c) an evaluation of the CDMP long-term time horizon in relation to addressing projected long-range climate change impacts.”

- b. LU-3F. “By 2017, Miami-Dade County shall develop a Development Impact Tool or criteria to assess how proposed development and redevelopment project features including location, site design, land use types, density and intensity of uses, landscaping, and building design, will help mitigate climate impacts or may exacerbate climate related hazards. The tool would also assess each development’s projected level of risk of exposure to climate change impacts, such as inland flooding.”
- c. LU-3G. “Miami-Dade County shall, by 2017, analyze and identify public infrastructure vulnerable to sea level rise and other climate change-related impacts. This analysis shall include public buildings, water and waste water treatment plants, transmission lines and pump stations, stormwater systems, roads, rail, bridges, transit facilities and infrastructure, airport and seaport infrastructure, libraries, fire and police stations and facilities.”
- d. LU-3H. “In order to address and adapt to the impacts of climate change, Miami-Dade County shall continue to improve analysis and mapping capabilities for identifying areas of the County vulnerable to sea level rise, tidal flooding and other impacts of climate change.”
- e. LU-3K. “By 2017, Miami-Dade County shall determine the feasibility of designating areas in the unincorporated area of the County as Adaptation Action Areas as provided by Section 163.3177(6)(g)(10), Florida Statute, in order to determine those areas vulnerable to coastal storm surge and sea level rise impacts for the purpose of developing policies for adaptation and enhance the funding potential of infrastructure adaptation projects.”
- f. TE-1H. “Transportation agencies developing their transportation plans for Miami-Dade County shall take into consideration climate change adaptation and mitigation strategies through project review, design, and funding for all transportation projects. Transportation agencies should consider extending their planning horizons appropriately to address climate change impacts.”
- g. TC-6D. “New roadways shall be designed to prevent and control soil

erosion, minimize clearing and grubbing operations, minimize storm runoff, minimize exposure and risk of climate change impacts such as increased flood conditions, and avoid unnecessary changes in drainage patterns.”

- h. CM-9H. “Rise in sea level projected by the federal government, and refined by the Southeast Florida Regional Climate Change Compact, shall be taken into consideration in all future decisions regarding the design, location, and development of infrastructure and public facilities in the County.”
- i. ICE-5G. “All County departmental master plans and strategic business plans shall include and prioritize climate change mitigation and adaptation strategies. Climate change related amendments shall be recommended through the next feasible, regularly scheduled amendment process or departmental master plan update for each respective planning document. a) Each County department shall consider extending planning horizons (i.e. 30, 50, 75-year plans) as appropriate to adequately address the projected longterm climate change impacts into resource allocation recommendations. b) All new departmental climate change policies and programs shall be monitored for effectiveness.”

6) Monroe County

I. [Comprehensive Plan](#)

- a. Policy 212.2.1 “Minimum coastal construction setbacks currently in use in Monroe County shall be reviewed in coordination with DNR and FGFWFC. Setbacks shall be identified which will accomplish the following... (4) protect structures from the effects of long-term sea level rise ...”

II. Land Development Code (MuniCode)

- b. Sec. 118-12. - Shoreline setback. (a) Purpose. “The purpose of this section is to allow for reasonable access between the land and water, provide secure boat storage, ensure good water quality, provide an appearance consistent with community character, protect structures from the effects of longterm sea level rise, protect beaches and shores from erosion, protect over-water views, avoid adverse impacts on navigation, and protect marine and terrestrial natural resources.”

III. [Monroe County Climate Action Plan](#) (2013) (County is currently developing comprehensive plan policies to help implement portions of the Climate Action Plan)

7) Palm Beach County

I. [Comprehensive Plan](#)

- a. Page 10: “SUB-OBJECTIVE 1.1.1 Climate Change Palm Beach County shall adopt, implement, and encourage strategies which increase community resiliency and protect property, infrastructure, and cultural and natural resources from the impacts of climate change, including sea level rise, changes in rainfall patterns, and extreme weather events.
- b. Policy 1.1.1-e: “Palm Beach County shall, by 2017, consider the use of Adaptation Action Areas as provided by section 163.3177(6)(g)(10), Florida Statutes, as a tool to identify areas vulnerable to coastal storm surge and sea level rise impacts, for the purpose of developing policies for adaptation and enhancing funding potential of infrastructure adaptation projects.”
- c. “Changes along the Palm Beach County shoreline are a consequence of natural and manmade factors that include storm effects, sea-level rise, inlet/navigation project impacts, and shoreline structures for the protection of coastal development.”

8) Pinellas County

I. [Comprehensive Plan](#)

- a. Planning to Stay Element, Governing Principles, Prepare for Disasters and Climate Change: “Principle 1: Planning for development must respect the restrictions imposed by the County’s susceptibility to natural disasters, and should anticipate potential alterations to the urban and natural environment induced by long-term changes in the climate.”
- b. Coastal Mgmt. Element, Introduction, p. 6-3: “Site differences, the potential enormity of the issue and the far-reaching human and environmental effects of sea level rise response are all important reasons why it is necessary to begin planning and considering all options.”
- c. Coastal Mgmt. Element, Introduction, p. 6-2: “As sea levels encroach further onto the land, there are three broad response scenarios, as defined by the Coastal Zone Management Subgroup of the Intergovernmental Panel on Climate Change Response Strategies Working Group. Those scenarios are: retreat, accommodation and protection.”

II. [Compendium of Goals](#)

- d. Nat. Res. & Cons. Element: 7.2.3. Policy: In association with the update to the Land Development Code, determine whether there is a need to further amend the Comprehensive Plan and land development regulations to protect public and private coastal infrastructure and investment from the inland advancement of coastal waters, and to coordinate land use planning decisions with the expectations of sea level rise.
- e. Coastal Mgmt. Element: 4.6. Objective: In an effort to ensure the long-term viability and sustainability of its coastal resources and land uses, Pinellas County will remain apprised of, and plan where appropriate for rising sea levels.
- f. Coastal Mgmt. Element: 4.6.1. Policy: Pinellas County will evaluate the data and findings regarding sea level rise on at least a five-year basis.
- g. Coastal Mgmt. Element: 4.6.2. Policy: Based on the evaluations directed by Policy 4.6.1, Pinellas County will continue to refine and incorporate long-term planning strategies, and amend land development regulations as necessary, to responsibly plan for the effects of rising sea levels.
- h. Coastal Mgmt. Element: 4.6.3. Policy: Pinellas County recognizes the potential need for adequate coastal buffering in its response to future sea level rise, and will give preference to low environmental impact methods of shoreline protection, such as beach nourishment, where feasible and appropriate.
- i. Coastal Mgmt. Element: 4.6.4. Policy: Pinellas County will encourage, and participate in, coordinated intergovernmental and interagency efforts to develop responsible strategies for addressing the potential negative effects of rising sea levels.
- j. Coastal Mgmt. Element: 4.6.5. Policy: Pinellas County will share information with local municipalities regarding the implications of sea level rise and development decisions along the coast and other vulnerable areas.

9) Sarasota County

I. [Comprehensive Plan](#)

- a. Environmental Chapter
- b. --“Both natural and man-induced processes can cause beach erosion. Natural causes include: • Storm waves; • Sediment supply to the littoral zone; • Wave and storm surge overwash; • Deflation (i.e., wind erosion of loose sands from the beach); • Longshore sediment

transport; • Sorting of beach sediment; and • Sea level rise. A recent study by the United States Environmental Protection Agency predicts that global sea level is likely to rise 5.9 inches (15cm) by the year 2050 as a result of human-induced climate warming (Berger and Iams 1996).”

- c. --“Sea Level Rise Global temperature has increased approximately 1 degree Fahrenheit in the last century as a result of natural [e.g., the earth experiences periodic cycles (Milankovitch cycles) of global warming and cooling] and anthropogenic factors (e.g., greenhouse gas emissions). As temperatures increase, climactic changes occur, sea waters expand and glaciers melt. Changes in relative sea level will alter the position and morphology of our coastline, causing coastal flooding, waterlogged soils, and a loss or gain of land. Eustatic (worldwide) sea levels are expected to increase 40 to 65 cm (1.3 to 2.1 feet) by the year 2100. These changes may also create or destroy coastal wetlands and salt marshes, inundate coastal sediments, and induce water saltwater intrusion into aquifers, leading to salinization of groundwater. Further inland intrusion of saltwater along our shorelines will affect the health, composition, and aerial coverage of our coastal ecosystems and habitats (Source: National Park Service). Changing sea level will also have effects on coastal construction. Scientists estimate that 70 percent of the world’s sandy beaches are affected by coastal erosion induced by relative sea-level rise (Berger and Iams 1996). How our community responds to these changes may very well determine whether we will have beaches or hardened shorelines in their stead.”
- d. --“Information regarding the historic and predicted sea level rise and projected shoreline changes should also be considered in the development of a bay-wide management plan and in the adoption of management guidelines.”
- e. Policy 1.2.3.: “By 2015, develop a Beach and Inlet Management strategy with a monitoring program for Sarasota County, incorporating regional coordination and interaction, to: • assess the nature and extent of coastal erosion; • monitor the effectiveness of beach restoration programs; • determine the effect of storm events on sand movement; • identify dominant coastal processes which would aid in evaluating permit applications and coastal decision making; • incorporate the long-term effects of sea level rise within the management policies.”

10)St. Lucie County

I. [Comprehensive Plan](#)

- a. Coastal Management Element Policy 5.1.1.10 – “The County shall continue to monitor all credible climate change and sea level rise data and what direct and potential effects this has on the coastal system natural resources. Based on this data the County shall evaluate and update the resource protection standards of the Land Development Code and this plan as necessary.”
- b. Coastal Management Element Policy 5.2.1.6 – “The County shall consider the most current and credible sea level rise data when planning long term infrastructure and capital improvement expenditures and land use amendments in areas less than 10 feet in elevation.”
- c. Conservation Element Policy 6.1.12.12 – “The County shall continue to monitor all credible climate change and sea level rise data and what direct and potential effects this has on natural resources. Based on this data the County shall evaluate and update the resource protection standards of the Land Development Code and this plan as necessary.”

11) Volusia County

I. [Comprehensive Plan](#)

- a. Coastal Management Element 11.4.1.21 “Volusia County should continue to monitor sea level rise science to determine how sea level rise will affect the County. Based on pertinent data, the County will act accordingly.”

III. ¹⁾ Municipalities

Fernandina Beach

2030 Comprehensive Plan, Goal 5: Conservation & Coastal Management Element
 (available at <http://www.fbfl.us/DocumentCenter/View/13133>)
 Policy 5.04.10.

The City recognizes sea-level rise as a potential coastal hazard, and shall work with Nassau County and state and regional entities as appropriate to develop strategies for responding to sea-level rise, including:

- a. Analysis of the estimated sea-level rise and its effects on estuaries, wetlands, beaches, and uplands;
- b. Identification of structures and areas of possible risk;
- c. Determination of additional data and research needed;

- d. Assistance from state and federal agencies;
- e. Analysis of City and County buffer requirements and whether additional buffering should be required;
- f. Evaluation of locating public facilities in areas projected to be affected by rising sea level;
- g. Consideration of the effects of sea-level rise on potable water sources, saltwater intrusion, septic systems, wastewater treatment facilities, and the water table; and
- h. Creation of Adaptation Action Areas, as permitted by state statute.

Fort Lauderdale

- 2) I. Comprehensive Plan amendment (not available on towns website; copy on file with author)
 - a. Coastal Mgmt. Element, Goal 3: “Increase the City’s resiliency to the impacts of climate change and rising sea levels by developing and implementing adaptation strategies and measures in order to protect human life, natural systems and resources and adapt public infrastructure, services, and public and private property.”
 - b. Coastal Mgmt. Element, Objective 3.1: “Develop and implement adaptation strategies for areas vulnerable to coastal flooding, tidal events, storm surge, flash floods, stormwater runoff, salt water intrusion and other impacts related to climate change or exacerbated by sea level rise, with the intent to increase the community’s comprehensive adaptability and resiliency capacities.” & “Evaluation Measure: Collaborating with regional partners, City shall identify public investments, infrastructure and assets at risk from rising sea levels by 2018. Thereafter, this assessment will be performed every five (5) years.”
 - c. Coastal Mgmt. Element, Policy 3.1.1: “Identify public investments and infrastructure at risk to sea level rise and other climate related impacts. Assess the vulnerability to public facilities and services, including but not limited to water and wastewater facilities, stormwater systems, roads, bridges, governmental buildings, hospitals, transit infrastructure and other assets.”
 - d. Coastal Mgmt. Element, Policy 3.1.2: “Adaptation strategies may include, but not be limited to:
 - a. Public infrastructure planning, siting, construction, replacement, operation and maintenance

- b. Emergency management
 - c. Stormwater management
 - d. Land development regulations
 - e. Building codes
 - f. Comprehensive planning
 - g. Other strategies”
- e. Coastal Mgmt. Element, Policy 3.1.3: “Adaptation strategy options may include the designation of Adaptation Action Areas (AAAs). As per Section 163.3164(1) and Section 163.377(6)(g)(10), Florida Statutes, an AAA is an optional designation within the coastal management element of a local government’s comprehensive plan which identifies one or more areas that experience coastal flooding due to extreme high tides and storm surge, and that are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure and adaptation planning.”
- f. Coastal Mgmt. Element, Policy 3.1.4: “AAAs’ adaptation strategy options may include, but not be limited to:
- a. Protection
 - b. Accommodation
 - c. Managed retreat
 - d. Avoidance
 - e. Other options”
- g. Coastal Mgmt. Element, Policy 3.1.5: “Considerations for AAAs designation may include, but not be limited to:
- a. Areas which experience tidal flooding, storm surge, or both
 - b. Areas which have an hydrological connection to coastal waters
 - c. Locations which are within areas designated as evacuation zones for storm surge
 - d. Other areas impacted by stormwater/flood control issues”
- h. Coastal Mgmt. Element, 3.1.6: “As a basis for the designation of AAAs, the City will utilize the best available data and resources, such as the Unified Sea Level Rise Projection for Southeast Florida and Broward County’s Priority Planning Areas for Sea Level Rise Map, in order to identify and understand the risks, vulnerabilities and opportunities to formulate timely and effective adaptation strategies,”
- i. Coastal Mgmt. Element, Policy 3.1.7: “As deemed to be in the best interest of the City, the City Commission may designate or remove designation by means of, but not limited to, the following mechanisms:

- a. Comprehensive Plan via location description or map, and in accordance with applicable Florida Statutes
- b. City Commission Resolution or Ordinance
- c. Community Investment Program (Capital Improvement Plan)
- d. Other mechanisms as appropriate”
- j. Coastal Mgmt. Element, Policy 3.1.8: “Potential funding sources for the implementation of AAA’s associated adaptation strategies include, but are not limited to:
 - a. Federal and State grants and technical expertise assistance (in-kind)
 - b. Local Stormwater Utility Fees and Community Investment Program (Capital Improvement Plan) prioritization
 - c. Public/Private Partnerships
 - d. Other sources”
- k. Coastal Mgmt. Element, Policy 3.1.9: “Integrate AAAs into existing and future City processes and city-wide plans and documents which may include, but not be limited to:
 - a. Community Investment Program
 - b. Local Mitigation Strategy
 - c. Strategic Plan
 - d. Sustainability Action Plan
 - e. Stormwater Master Plan
 - f. Comprehensive Emergency Management Plan
 - g. Unified Land Development Regulations
 - h. Other related processes, plans and documents.”
- l. Coastal Mgmt. Element, Policy 3.1.10: “Align and be consistent with, to the extent possible, relevant and current national, state, and regional adaptation strategy documents such as the Broward County Climate Action Plan, Southeast Florida Regional Climate Action Plan and The President’s Climate Action Plan as well as other regional strategic plans, disaster mitigation plans, water management plans, transportation/transit plans, and climate change plans.”
- m. Coastal Mgmt. Element, Policy 3.1.11: “Participate in, when appropriate, coordinated governmental, non-governmental and other appropriate agencies’ proposed application requests for funding adaptation implementation projects.”
- n. Coastal Mgmt. Element, Policy 3.1.12: “Collaborate and coordinate

with appropriate local, regional and state governmental agencies, to the extent possible, toward the implementation of AAA adaptation strategies.”

- o. Coastal Mgmt. Element, Policy 3.1.13: “Based on evolving rising seas data and associated vulnerabilities, to allow for flexible adjustments, preserve future strategic adaptation implementation options to maintain maximum resiliency in response to new risks and vulnerabilities. The City will take advantage of new emerging data and technological opportunities.”
- p. Coastal Mgmt. Element, Policy 3.1.14: “Continue to foster effective collaborations, partnerships and coordination with national, state, regional and local partners to identify risks, vulnerabilities and opportunities associated with coastal hazards and the impacts from sea level rise.”
- q. Admin. & Implementation Element (VII. Definitions): “Priority Planning Areas for Sea Level Rise Map, Broward County: Map which identifies and illustrates vulnerable areas within Broward County that are at increased risk of flooding due to, or exacerbated by, sea level rise over the next fifty (50) years. Broward County generated this map in partnership with the South Florida Water Management District and the National Oceanographic and Atmospheric Administration.”
- r. Admin. & Implementation Element (VII. Definitions): “Protection: Strategies that involve “hard” and “soft” structurally defensive measures to mitigate impacts of rising seas in order to decrease vulnerability while allowing structures and infrastructure to remain unaltered. Two examples are shoreline armoring and beach renourishment. Protection strategies may be targeted for areas of a community that are location-dependent and cannot be significantly altered or relocated, such as downtown centers, areas of historical significance, or water-dependent uses. (Adaptation Action Areas: Policy Options for Adaptive Planning For Rising Sea Levels, South Florida Regional Planning Council, 2013).”
- s. Admin. & Implementation Element (VII. Definitions): “Accommodation: Strategies that do not act as a barrier, but rather alter the design through measures such as elevation or stormwater improvements, to allow the structure of infrastructure system to stay intact. Rather than preventing flooding or inundation, these strategies aim to reduce potential risks. (Adaptation Action Areas: Policy Options for Adaptive Planning For Rising Sea Levels, South Florida Regional Planning Council, 2013).”

- t. Admin. & Implementation Element (VII. Definitions): “Managed Retreat: Strategies that involve the actual removal of existing development, their possible relocation to other areas, and/or prevention of further development in high-risk areas. (Adaptation Action Areas: Policy Options for Adaptive Planning For Rising Sea Levels, South Florida Regional Planning Council, 2013).”
- u. Admin. & Implementation Element (VII. Definitions): “Avoidance: Strategies that involve ensuring development does not take place in areas subject to coastal hazards associated with sea level rise or where the risk is low at present but will increase over time. (Adaptation Action Areas: Policy Options for Adaptive Planning For Rising Sea Levels, South Florida Regional Planning Council, 2013).”

3) Fort Pierce

I. [Comprehensive Plan](#)

- a. 5.1.10 Policy: “The City shall maximize protection of coastal and marine resources by evaluating the potential impact identified by the applicant and other public entities having jurisdiction over the impacted resources. The development review process shall ensure compliance with levels of service and policies of the Plan and shall evaluate the following: ... ‘Protection of structures from the effects of long-term sea level rise...’”
- 4) b. 5.8.11 Policy: “The City shall continue to monitor updates to sea level rise forecasts and predictions and consider measures to protect or relocate all critical public facilities that are located in areas projected to be impacted by sea level rise in the next 50 years.”

Hallandale (Beach)

I. [Comprehensive Plan](#)

- 5) a. “Sediment erosion and transport is a natural phenomenon that will continue if not increase (because of rising sea levels), and continued beach management will be required in the future if existing beach resources are to be maintained.”

Hollywood

I. [Comprehensive Plan](#)

- a. Sea Level Rise - “In a presentation to the Water Resource Advisory Board and Technical Advisory Committee on September 21, 2006, Dr. Hal Wanless of the University of Miami predicted a sea level rise for Broward County of 1 foot in the next 100 years. This is in addition to the 0.7 foot rise established to have occurred in the past 70 years. Rising sea levels will lead to local water problems such as worse drainage for flood events, more harm from beach erosion and hurricanes, more salt water intrusion, loss and alteration of salt and fresh wetlands, along with building siting and preparation issues in anticipation of higher base water levels. Current and credible sea level rise data should be considered when planning long term infrastructure and capital improvements activities, and in future land use decisions.”

Islamorada

II. Code of Ordinances (Municode)

6)

- a. Sec. 30-1543. Shoreline environmental and development criteria.(a)
The purpose of this section is to allow for reasonable access between the land and water, protect marine and terrestrial natural resources, assure good water quality, provide a consistent community character, protect structures from the effects of long-term sea level rise, protect beaches and shores from erosion, avoid adverse impacts on navigation and provide secure boat storage.

7)

Key West

I. [Comprehensive Plan](#)

- a. Definitions: “Climate Change – Long-term changes in temperature, precipitation, wind and all other aspects of the Earth's climate that cause increasingly severe natural disasters.”
- b. Definitions: “Climate Change Adaptation – Adjustments to natural or human systems in response to actual or expected climatic factors or their effects, including sea level rise, more frequent and intensified storm events, and changes in rainfall.”
- c. Future Land Use Element, “Policy 1-1.1.14: Prepare for Future Sea Level Rise. The City, together with the private sector, shall consider proactive steps and pilot programs to adapt for sea level rise and storm surges, including but not limited to preserving transportation options, increasing residential building resiliency and indoor air quality, preserving landscaping and residential building aesthetics, and preserving water quality.”
- d. Future Land Use Element, “Policy 1.1.4.6: Increase Resilience of General Landscaping. The City shall use best available science and

predictions for sea level rise and other climate change related issues to guide the long term health and appearance of landscape plantings. By 2014 the City shall work with sea level rise and native plant experts to create a “Climate Adaptation Planting Plan” ordinance to affect landscaping plans. This plan shall be reviewed every other year to stay up to date with climate change predictions.”

- e. Future Land Use Element, “Objective 1-1.12: CONSIDER APPLICATION OF INNOVATIVE LAND AND WATER RESOURCE MANAGEMENT, CLIMATE ADAPTATION, AND ENERGY CONSERVATION CONCEPTS. The City of Key West shall maintain Land Development Regulations which incorporate concepts for managing land, water, and energy resources which are responsive to unique development and conservation issues identified in the City's Comprehensive Plan. The City of Key West shall adopt Land Development Regulations which incorporate concepts for managing land, water, and the built environment which are responsive to climate change issues including but not limited to sea level rise and increased frequency of intense rainfall events...”
- f. Future Land Use Element, “Objective 1-1.12: The City’s Land Development Regulations shall incorporate climate adaptation techniques which have been demonstrated to be successful and cost effective in adapting to climate change issues including but not limited to sea level rise ...”
- g. Future Land Use Element, “Policy 1.1.12.5: Increased Height: The City shall consider allowing increased heights for new construction or redevelopment if such additional height is justified based on adopted Coastal High Hazard Maps and Storm Surge Flood Maps in order to promote safe new development and redevelopment based on sea level rise predictions. Such additional height must be compatible with surrounding development.”
- h. Transportation Element, “Policy 2-1.3.4: Climate Change Preparedness. The City shall consider current science and predictions for sea level rise and other climate change issues in planning future roadway improvements.”
- i. Conservation Element, “Policy 6-1.12.1: Review the Impact of Changing Conditions on Conservation Policy. The City shall monitor and evaluate significant changes, including climate change, in the characteristics of natural resources within the City. Policy implications of such changes shall be examined and corrective measures shall be pursued. Conservation policies shall be refined as needed in order to

remain responsive to evolving problems and issues.”

- j. Conservation Element, “Objective 6-1.14: CARBON SEQUESTRATION THROUGH PLANTS. As part of an overall landscaping plan to increase beautification and walkability, the City shall incorporate greenhouse gas sequestration goals and priorities to meet the City’s Climate Action Plan goals.”
- k. Capital Improvements Element--Climate Change Preparation, section 9-3(14): The City Planner and City Engineer shall review the latest science and predictions for sea level rise and other climate change related issues and recommend any needed action to address currently scheduled or future projects.”
- l. Coastal Management Element, “Policy 5-1.5.3: Adaptation Action Areas. For hazard mitigation purposes, the City may create Adaptation Action Areas which identify one or more areas that experience coastal flooding due to extreme high tides and storm surge, and that are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure needs and adaptation planning.”

Lauderdale-by-the-Sea

8)

I. [Comprehensive Plan](#)

- a. Policy 6.4.8: “The Town shall implement measures that supports mitigation and sensitivity to the impacts of climate change in coordination with other municipalities, Broward County, private businesses, other governmental agencies and the State of Florida. This program will focus on mitigating the causes and consequences of greenhouse gas emissions in a cost-effective and efficient manner that preserves the Town’s overall values and quality of life.”
- b. Greenhouse Gas Emissions: Greenhouse Gas Emissions “According to the “Ecological Impacts of Climate Change” by the National Academy of Sciences (NAS), the world’s climate is changing, and it will continue to change throughout the 21st century and beyond. Rising temperatures, new precipitation patterns, and other changes are already affecting many aspects of human society and the natural world. A relatively rapid increase in temperature has been documented during the past century, both at Earth’s surface and in the oceans.”
- c. Page IV-15: “The State of Florida with almost 1,350 miles of shoreline and the associated coastal population concentrations is particularly susceptible to rising sea levels associated with climate change.”
- d. Page IV-14: “Under a ‘business-as-usual’ greenhouse gas emissions scenario, models indicate that sea levels could rise 2 feet or more by

2100 compared to 1990 levels.”

Miramar

I. [Comprehensive Plan](#)

- 9) a. Policy 9.11: “Miramar shall coordinate with the county-wide Climate Change Program to mitigate and adapt to the consequences of climate change in coordination with other local governments, private businesses, other governmental agencies and the State of Florida. This program will focus on mitigating the causes and consequences of greenhouse gas emissions in a cost-effective and efficient manner that preserves the City of Miramar economic competitiveness.”

Neptune Beach

I. [Comprehensive Plan](#)

- 10) a. Page E-10: “The marsh was examined at several locations by a biologist in March 1988 and appears to be in reasonably good condition. There are scattered dead or dying cabbage palms in the Hopkins Creek marsh which are probably evidence of sea level rise or culturally induced salinity increases, or both.”
- b. Page E-11: “The single greatest cause of beach erosion has been and will continue to be offshore sediment transport, which results from the rising sea level. Studies have shown that sea level has been rising at an average rate of 0.7 to 1.0 foot per century. For every foot in rise there is a loss of 30 feet of beach due to erosion. Therefore, a potential loss of 3.6 feet of beach per year exists solely from sea level rise.”
- 11)

New Smyrna Beach

I. [Comprehensive Plan](#)

- a. Future Land Use Goals and Policy: “Explore various funding opportunities to assist in developing City GHGs emissions baseline data, in order to set GHG emission goals, to develop strategies to reduce climate change and to mitigate and adapt to its impacts.”
- b. Future Land Use Goals and Policy: “Continue to provide educational materials regarding energy efficiency, sustainable design, and climate change that encourage community residents and business owners to invest in energy-efficiency improvements through community outreach efforts.”
- c. Coastal Management Policy: “Work with Volusia County to develop strategies for responding to sea level rise, including: i. Analysis of the estimated sea level rise and its effects on estuaries, wetlands, barrier islands, and uplands. ii. Identification of structures and areas of

possible risk. iii. Determination of additional data and research needed. iv. Assistance from state and federal agencies. v. Analysis of Volusia County environmental buffer requirements and whether dune buffers should be required. vi. Evaluation of locating public facilities in areas projected to be affected by rising sea level. vii. Consideration of the effects on potable water sources, saltwater intrusion, septic systems, wastewater treatment facilities, and the water table.”

Ormond Beach

I. [Comprehensive Plan](#)

- 12) a. Policy 2.6.11. and 1.3.3: “Provide educational materials regarding energy efficiency, sustainable design, and climate change that encourage community residents and business owners to invest in energy-efficiency improvements through community outreach efforts, such as the City’s Website.”

Palm Beach Shores

I. [Comprehensive Plan](#)

- 13) a. 06.01.01.05 “The Town shall implement a Climate Change Program that supports mitigation and sensitivity to the impacts of climate change in coordination with other municipalities, Palm Beach County, private businesses, other governmental agencies and the State of Florida. This program will focus on mitigating the causes and consequences of greenhouse gas emissions in a cost-effective and efficient manner that preserves the Town’s overall values and quality of life.”
- 14)

Pinecrest

- I. Note: The Village of Pinecrest presents an interesting scenario since it is not, according to the State of Florida, a local government that is even required to have an coastal management in their comprehensive plan and they do not, in fact, have a coastal management element in their comprehensive plan. Nonetheless, the Village of Pinecrest has a very comprehensive approach to SLR built into this addition to its comprehensive plan. Despite the fact that Pinecrest does not directly abut the ocean, it is very, very close. This combines with the low-lying, flat topography of the area to mean that Pinecrest is smart to plan for the impacts of SLR on the community.
- II. Comprehensive Plan: Climate Change Element (copy on file with principal author)
- a. **Policy 9-1.2.2: Complete a Vulnerability Assessment for the Identification of Property and Infrastructure at Risk from Sea Level Rise.** The Village of Pinecrest shall complete a vulnerability

assessment to further identify property, public investments and infrastructure at risk from sea level rise, storm surge, groundwater contamination and other climate change related impacts by 2016, and shall update this assessment periodically as new sea level rise projections are published. Specifically, the Village shall complete a stormwater vulnerability assessment to further analyze vulnerability to facilities and services, including but not limited to: property; buildings; water and sewer lines; stormwater systems; roads, bridges, and all transportation infrastructure; electric sub stations; and municipal offices and facilities.

- b. **Objective 9-1.6: ADAPTATION ACTION STRATEGIES.** Develop and implement adaptation strategies for the Village of Pinecrest to address impacts associated with coastal flooding, tidal events, storm surge, flash floods, stormwater runoff, salt water intrusion and other impacts related to climate change or exacerbated by sea level rise with the intent to increase the Village's comprehensive adaptability and resiliency capacities.
- c. **Policy 9-1.6.1: Options.** Adaptation Action Areas adaptation strategy options may include but not be limited to:
 - a. Protection
 - b. Accommodation
 - c. Managed Retreat
 - d. Avoidance
 - e. Other Options
- d. **Policy 9-1.6.2: Collaborate with the South Florida Water Management District in the Review of Policies Regarding Operation of Flood Control Structures.** Work in collaboration with the South Florida Water Management District to review, develop and implement strategies to address impacts of rising sea levels on and adjust policies related to the operation of the flood and salinity control structures at the S22 and S123 outfalls, and to consider policies and protocol regarding forward pumping as a means of reducing and controlling stormwater flooding levels during periods of inundation.
- e. **Policy 9-1.6.3: Backflow Preventers.** Consider the installation of backflow preventers on drainage systems that discharge to Biscayne Bay or drainage canals, coordinating with Miami-Dade County DERM as necessary or required.
- f. **Policy 9-1.6.4: Reassess the Village's Required Minimum Base Flood Finished Floor Elevation.** Consider increasing the minimum

required base flood finished floor elevation of all new structures within designated Adaptation Action Areas by one additional foot (freeboard).

- g. **Policy 9.1.6.6: Collaborate with Governmental Agencies In The Implementation of Mitigation Strategies.** Collaborate and coordinate with appropriate local, regional, and state governmental agencies including the City of Coral Gables, Miami-Dade County, the South Florida Water Management District, and the South Florida Regional Planning Council toward the implementation of Adaptation Action Area adaptation strategies.
- h. **Policy 9.1.6.9: Review the County's established Salt Barrier Line.** Coordinate with Miami-Dade County in the review of the Salt Barrier Line as previously established for the segment of the line located between the Village and Biscayne Bay in an effort to determine whether the legislation needs to be amended due to increases in sea level and to help identify measures and improvements necessary to protect against salt water intrusion in the area of the established line.
- i. **Objective 9-1.7: ADAPTATION ACTION AREAS.** The Village of Pinecrest shall continue to identify and designate Adaptation Action Areas as provided by Section 163.3164(1), Florida Statute, and develop policies for adaptation as required for the protection of areas and facilities in the Village of Pinecrest that are vulnerable to the impacts of rising sea levels and climate change.
- j. **Policy 9-1.7.1: Areas For Consideration.** Consideration of Adaptation Action Areas designation shall include but shall not be limited to:
 - a. Areas which have a hydrological connection to coastal waters and are vulnerable to flooding.
 - b. Locations which are within areas designated as evacuation areas for storm surge.
 - c. Other areas impacted by stormwater/flood control issues.
- k. **Policy 9-1.7.2: Basis For Designation.** As the basis for the designation of Adaptation Action Areas, the Village will continue to utilize the best available data and resources such as the Unified Sea level Rise Projection for Southeast Florida in order to identify the risks and vulnerabilities associated with climate change and sea level rise and opportunities to formulate timely and effective adaptation strategies.
- l. **Policy 9-1.7.3: Adaptation Action Areas Identified.** Those Areas as

identified in Figure 11 of the data, Inventory and Analysis, Adaptation Action Areas, that are projected to be impacted by 6 or More Inches of Flooding, are hereby adopted and designated as Adaptation Action Areas.

- m. **Objective 9-1.8: INTERAGENCY COORDINATION.** Continue to coordinate with Governmental agencies within the South Florida region and other non-governmental entities and academic institutions in the ongoing assessment of existing and projected conditions related to our changing climate and rising sea levels, and continue to collaborate as necessary in the identification and development of effective solutions and strategies to adapt and improve resiliency.
- n. **Policy 9-1.8.2: Continue To Coordinate With Other Governmental and Academic Entities In The Ongoing Analysis of Sea Level Rise.** The Village of Pinecrest shall continue to coordinate regionally with Southeast Florida counties and municipalities, academia, and state and federal government agencies in the analysis of sea level rise, drainage, storm surge and hurricane impacts and the planning of mitigation and adaptation measures.
- o. **Policy 9-1.8.3: Continue To Monitor And Coordinate With The Southeast Florida Regional Climate Change Compact.** The Village of Pinecrest shall continue to actively monitor the Southeast Florida Regional Climate Change Compact, and shall coordinate with neighboring municipalities to make our community more climate change resilient by sharing technical expertise, assessing regional vulnerabilities, advancing agreed upon mitigation and adaptation strategies, and developing policies and programs./

15) III. Also see, “Exhibit B” to Ordinance No. 2015-4 (April 14, 2015), “Climate Change Element Data, Inventory and Analysis.

Palm Coast

- I. Local Mitigation Strategy (as of mid-June, 2015, Palm Coast is working on a rewrite of their Local Mitigation Strategy and intend to add SLR as a recognized hazard; may contact Denise Bevan for more info as well as Laura Nelson, Flagler County Emergency Manager who is leading the rewrite. More info at <http://www.flagleremergency.com/pages.php?pid=62>

Pompano Beach

- I. [Comprehensive Plan](#)
 - a. Land Use: “The warmer temperatures not only cause glaciers and land ice to melt (adding more volume to oceans) but also cause seawater to expand in volume as it warms. The global average sea level rose by

just under .07 inches per year during the 20th century, but that number has risen to .12 inches per year since the early 1990s. Under a ‘business-as-usual’ greenhouse gas emissions scenario, models indicate that sea levels could rise 2 feet or more by 2100 compared to 1990 levels.”

- b. Transportation: “The State of Florida with almost 1,350 miles of shoreline and the associated coastal population concentrations is particularly susceptible to rising sea levels associated with climate change. In response to the climate change threats, Governor Charlie Crist signed three (3) Executive Orders on July 13, 2007 establishing immediate actions to reduce greenhouse gas emissions within Florida.”
- c. Conservation 09.01.02: “The City shall implement a Climate Change Program that supports mitigation and sensitivity to the impacts of climate change in coordination with other municipalities, Broward County, private businesses, other governmental agencies and the State of Florida. This program will focus on mitigating the causes and consequences of greenhouse gas emissions in a cost-effective and efficient manner that preserves the City’s overall values and quality of life.”

17)

Port Orange

I. [Comprehensive Plan](#)

- a. Policy 1.1.1: “Explore various funding opportunities to assist in developing City GHGs emissions baseline data, in order to set GHG emission goals, to develop strategies to reduce climate change and to mitigate and adapt to its impacts.”
- b. Policy 1.1.13: “Continue to provide educational materials regarding energy efficiency, sustainable design, and climate change that encourage community residents and business owners to invest in energy-efficiency improvements through community outreach efforts, such as the City’s Green Initiative Website.”

18)

Port St. Lucie

I. [Comprehensive Plan](#)

- a. Policy 5.1.1.3: “The City may continue to monitor all credible climate change data and what direct and potential effects this may have on the coastal planning area and natural resources. Based on this data the City may evaluate and update the resource protection standards of the Land Development Code and this plan as necessary.”

Punta Gorda

I. [Comprehensive Plan](#)

- 19)
- a. Conservation & Coastal Management Element: “Objective 2.4.2: Address the impact of sea level rise, and seek strategies to combat its effects on the shoreline of the City.”
 - b. Conservation & Coastal Management Element: “Policy 2.4.2.: The City will work with the Southwest Florida Regional Planning Council to determine the potential sea level rise impacts on the Coastal Planning Area.”
- II. [City of Punta Gorda Adaptation Plan](#). This plan list numerous adaptations identified through a public process, including seagrass protection and restoration, Florida Friendly Landscaping, explicitly indicate in local master plans which areas will retain natural shorelines, build road and sidewalks of porous materials, improved flood plain management/regulation, increase stormwater capacity, constrain location of certain infrastructure, restrict fertilizer use, promote green building alternatives, and drought preparedness planning.

Satellite Beach

I. [Comprehensive Plan](#)

- 20)
- a. Coastal Mgmt/Conservation: Objective 1.12A “Development and redevelopment within the City shall be permitted only when consistent with sound planning practices that shall protect life and property from the effects of coastal erosion, flooding, sea level rise, or damage to environmental systems.”
 - b. Coastal Mgmt/Conservation: Policy 1.12A.1 – The City of Satellite Beach designates the Coastal High Hazard Area as “the area defined by the SLOSH model to be inundated from a Category 1 Hurricane”.
 - c. Coastal Mgmt/Conservation: Policy 1.12A.2 “The City of Satellite Beach designates the Adaptation Action Area (AAA) as that area which includes the CHHA and other areas of the City as may be identified by the City Council in the future as being subject to coastal erosion, flooding, sea level rise, or damage to environmental systems.”
 - d. Coastal Mgmt/Conservation: Objective 1.3 The City shall continue to limit use of public funds and discourage use of funds by other levels of government that subsidize new, private development or redevelopment in the Coastal High Hazard Area.
 - e. Coastal Mgmt/Conservation: Policy 1.3.2 - The City shall coordinate with service providers to replace and mitigate damaged infrastructure within the Coastal High Hazard Area and other parts of the Adaptation

Action Area consistent with other policies of the Comprehensive Plan. (Refer to Policy 1.12A.2 in which the Adaptation Area is established.)

- f. Coastal Mgmt/Conservation: Objective 1.4A The City shall strive to reduce the exposure of human life and public and private property to natural hazards while reducing the cost of flood insurance.
- g. Coastal Mgmt/Conservation: Policy 1.4A.1 - The City shall initiate a public process to identify Adaptation Action Areas (AAAs) in accordance with Sections 163.3164(1) and 163.3177(6)(g)10 Florida Statutes. The purpose of the AAAs is to increase grant and other funding opportunities and identify creative solutions to achieve the following goals:
 - Protect the health, safety and welfare of residents,
 - Prevent damage to public and private property, and
 - Reduce National Flood Insurance Program premiums to property owners.
- h. Coastal Mgmt/Conservation: Policy 1.4C.3 - The City shall encourage population concentrations away from known or predicted coastal high hazard areas consistent with the goals, objectives and policies of the Future Land Use Element in the Satellite Beach Comprehensive Plan. This policy is not intended to prohibit or discourage maintenance or replacement of existing development within the CHHA.

21)

West Palm Beach

22)

- I. [Sustainability Action Plan](#) (specifically pages 39-43)

Yankeetown

- I. [Coastal Change Adaptation Study](#) (this was conducted by a team from the University of Florida and *is not* a local government document)

IV. Conclusion

While this research revealed that only 26 of 195 local governments in Florida explicitly mention or address sea-level rise in their comprehensive plans, this number will likely grow very rapidly over the next few years as further research takes place and the “early adopters” provide the inspiration, direction, models, and resources other local governments need to move forward. The local governments that have been most active provide some excellent examples of how to integrate consideration of SLR into local government planning. A summary of salient points from these include:

- The local government is actively seeking out information on SLR and helping ensure that the public is aware of it and has access to SLR information;

- The local government is promoting a dialogue with and among citizens about the hazards of SLR and ways that it can be addressed at the local level;
- The local government is developing public involvement processes to evaluate potential adaptation strategies to current and projected SLR impacts;
- The local government collaborates with other local governments in development of regional models and resources;
- The local government is coordinating with other entities on issues such as transportation, water supply, and other critical infrastructure potentially at risk from SLR;
- The local government is itself conducting or using another entity's analysis of SLR impacts under various scenarios to:
 - Identify public infrastructure and public facilities at risk and to guide long-term capital investments in infrastructure,
 - Risk to homes and businesses,
 - Help guide planning to avoid putting more people at risk to SLR,
 - Revise land use, zoning, and hazard maps,
 - Integrate SLR into floodplain management and National Flood Insurance Program and Community Rating System activities as means to both minimize flood damage and to save constituents money,
 - Develop Adaptation Action Areas that may help address short- to medium-term infrastructure needs,
 - Create strategies to promote denser development in areas safest from SLR impacts,
 - Specifically add SLR to stormwater master planning, and
 - Integrate SLR generally into resilience planning at the local level;
- The local government is integrating SLR and SLR vulnerability analysis results into all relevant local government documents, such as Post-Disaster Redevelopment Plans, Comprehensive Plans, Stormwater Master Plans, Comprehensive Emergency Management Plans, the Local Mitigation Strategy, the Capital Improvements Plan, and others as appropriate;
- The local government is evaluating the potential impact of SLR on established "levels of service" for all potentially affected services (i.e.--water, sewer, transportation, etc.);
- The local government is using one or more planning horizons, at least one of which extends to at least 50 years into the future;
- The local government requires proposed development in an area at risk of SLR to explicitly indicate how the development's design takes this risk into account;
- The local government is integrating SLR into management and planning for natural resources such as wetlands, marshes, bays, mangroves, and beaches; and
- The local government is integrating SLR into calculations of potential storm surge and tidal flooding.

V. Appendix

While it is not possible to guarantee that there are not comprehensive plan or other local government documents in Florida that reference SLR that were missed during this research, the research was structured to identify those plans and documents reasonably available via electronic format. The research occurred in three main parts. First, researchers identified that subset of local governments in Florida considered “coastal” as defined by the requirement to prepare a “coastal management element” in the local government’s required comprehensive plan. This resulted in a total of 195 local governments identified (161 municipalities and 34 counties).

Next, researchers accessed the Municipal Code Corporations website (www.municode.com) to determine how many of these local governments had their comprehensive plan and/or code of ordinances available via Municode (133 of 161 municipalities and 30 of 34 counties). Those available were searched for multiple terms (“sea level rise,” “sea-level rise,” and “sea”); when sea-level rise or a relevant variant, the text was copied into a separate electronic document along with the reference for the document in which it appeared. Next, researchers searched another legal database—American Legal Publishing Corporation (<http://www.amlegal.com/>)—for local governments not available via the Municipal Code Corporation’s website (8 municipalities and 0 counties). Again, researchers conducted searches for terms and excerpted relevant portions.

Finally, for local governments not available at one of these databases, researchers sought a link to comprehensive plan documents on the local government’s website or via an internet search engine. In some cases searching of comprehensive plans via the local government’s website presented the obstacle that it would appear in separate pdf files for each chapter of the plan, thus requiring numerous searches across numerous documents for a single local government. Only a total of 5 of 195 local government comprehensive plans were not able to be located. Two additional plans were located piecemeal but were old and not available for electronic searches thus precluding their inclusion in this work.

